

**Apelco**

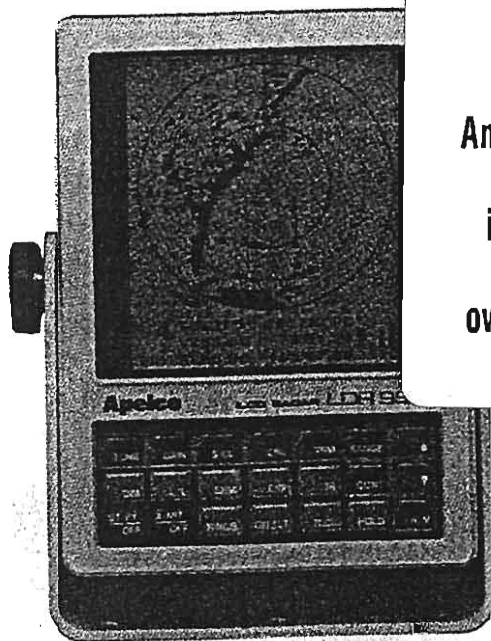
A **Raytheon** Company

**LDR 9910  
LCD RADAR**

**Distributed by**

**Raymarine**

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in this manual should be  
interpreted as Raymarine. The  
names Raytheon and RTN are  
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**INSTRUCTION MANUAL**

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# SECTION 1

## GENERAL DESCRIPTION

### 1.1 INTRODUCTION

Congratulations on selecting the APELCO LDR 9910 Radar for your radar navigation needs.

Whether you purchased this radar because of its compactness or power economy, ease of installation, or long term reliability, one thing is certain; the moment you turn on your LDR 9910 you'll know you are seeing a revolutionary new concept in radar technology at work.

Radar signals are "stored" on an LCD display with chart like clarity and detail. A single glance at your LDR 9910 display will give you a complete and accurate 360° radar picture of other vessels, bouys and land fall surrounding your vessel.

The EBL and VRM allow you to measure target bearing and range with high accuracy, and the Seaguard Alarm can alert you of targets entering into your safety zone.

A unique feature even allows you to "freeze" the picture for high accuracy bearing and range measurements.

With additional functions of "Offset", "Target Expansion" and "Interference Rejection" it should become apparent that human engineering and operational simplicity have been considered foremost in the LDR 9910's design.

However, please remember that the LDR 9910 is an aid to navigation and will provide you with valuable information concerning objects around your vessel. The radar does not replace any requirements for maintaining a concentrated visual observation and look out during the piloting of your vessel.

We trust that you will enjoy many years of excellent performance, reliability, and smooth sailing with your new LDR 9910 Radar.

## 1.2 PHYSICAL DESCRIPTION

### 1.2.1 General

The APELCO LDR 9910 Rader (product code M88344) consists of the following :

	<u>ITEM</u>	<u>APELCO PRODUCT CODE</u>
1 ea.	Display Unit	M88345
1 ea.	Scanner Unit w/inter unit cable	M88307
1 ea.	Power cable assembly (2m)	CFQ-2176
1 ea.	Instruction Manual	7ZPRD0153

### 1.2.2 Scanner Unit

The antenna, transceiver, and power supply are combined within an 18 inch radome which is made of AES plastic. A small flexible cable connects the scanner unit to the display unit. The radome cover is secured to the scanner base pan by four clamping bolts and provided with a rubber gasket to seal the unit from the weather and spray.

### 1.2.3 Display Unit

The Display Unit is enclosed in a drip-proof case and can be easily mounted on top of a chart table, or installed against a bulkhead. All controls for operating the LDR 9910 Radar are located on the front panel and positioned for easy adjustment during day or night use. A bearing scale is around the screen and is used to determine the relative bearing to targets.

### 1.2.4 LDR 9910 Optional Items

M88322 — Universal Sailboat Mast Mount - attractively styled for the LDR 9910 - fits all masts from 2" and up.

M88323 — 10M Extension Cable - Plugs into existing antenna cable assembly and allows up to 30 additional feet of separation between display and antenna unit.

1037339-1 — Raw Extension Cable - For installations when 10M extension cable is not required :

## 1.3 SPECIFICATIONS

### 1.3.1 General

- 1) Maximum Range 8 nautical miles
- 2) Minimum Range Better than 65 m on 0.25 nm range
- 3) Range Scales

Range	Range Ring Interval	No. of Rings
0.25 nm	0.125 nm	2
0.5 nm	0.25 nm	2
1 nm	0.5 nm	2
2 nm	1 nm	2
4 nm	2 nm	2
8 nm	4 nm	2

- 4) Range discrimination Better than 55 m
- 5) Range ring accuracy Better than  $\pm 2.5\%$  of maximum range of the scale in use, or 22 m, whichever is the greater.
- 6) Bearing accuracy Better than  $\pm 1$  degree
- 7) Liquid Crystal Display Effective area 92 x 110 mm
- 8) Environmental conditions
 

Scanner Unit	Temperature -15°C to +50°C
	Humidity Up to 95% at 35°C
	Wind Velocity Up to 50m/s as relative
Display Unit	Temperature -15°C to 50°C
	Humidity Up to 95% at 35°C
- 9) Input Power Requirement 13.6VDC  $\pm 15\%$
- 10) Power Consumption 35W (approximately)

### 1.3.2 Scanner Unit

- 1) Dimensions
 

Diameter of radome	18"(450mm)
Height	9.8"(227mm)
- 2) Weight Approximately 12.1 lb. (5.5kg)
- 3) Polarization Horizontal
- 4) Beam width
 

Horizontal	6°
Vertical	25°
- 5) Sidelobes Better than -21 dB

6) Rotation	Approximately 27 rpm
7) Drive motor input voltage	12VDC
8) Transmitter frequency	9445 $\pm$ 30 MHz
9) Peak power output	Typ. 1KW
10) Transmitter tube	Magnetron (AMC-1)
11) Pulse length	0.3us
12) Pulse repetition frequency	920Hz
13) Modulator	Solidstate modulator driving magnetron
14) Duplexer	T-junction with Diode Limiter
15) MIC frontend	Balanced mixer and FET osc.
16) IF amplifier	Center frequency      60 MHz
	Bandwidth              4 MHz
17) Overall noise figure	Better than 10 dB

### 1.3.3 Display Unit

1) Dimensions	Width 7.44" (189 mm) Depth 3.75" (111 mm) Height 8.86" (225 mm)
2) Mounting	Table, overhead, or bulkhead mounting
3) Weight	Approximately 3.3 lb. (1.5kg)
4) Range scales	0.25, 0.5, 1, 2, 4, 8 nm
5) Range rings	0.125, 0.25, 0.5, 1, 2, 4 nm
6) Bearing synchronizing system	Motor encoder
7) Tuning	Manual
8) Bearing scale	360° scale, graduated at intervals of 15°
9) Ship's heading marker	Electrical
10) Controls	POWER (ST-BY/OFF, X-MIT/OFF) RANGE (up/down) TUNE (up/down) GAIN (up/down) SEA CLUTTER (up/down) VRM (up/down) EBL (up/down) ALARM (up/down) CONTRAST (up/down) IR (SW) EXP (SW) RAIN CLUTTER (SW) OFFSET (SW) SHM (SW) RINGS (SW) HOLD (SW) DIMMER (SW) L/L (SW)

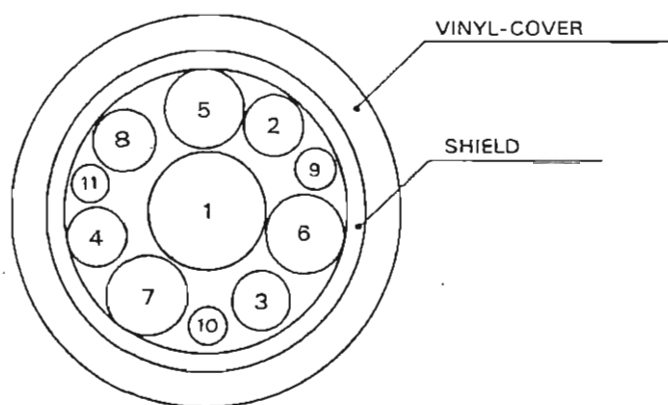
### 1.3.4 Inter-Unit Cable

	Type of Cable	Standard Length	Maximum Length
Scanner-Display	1037339-1	6 m	15 m

### 1.3.5 CABLE INFORMATION

#### Composite cable type 1037339-1

This cable is a vinyl-covered, shielded, 11 conductor cable connecting the scanner unit with the display unit. The specification of the cable is as follows :



Coductor (No.)	Cross Section (mm <sup>2</sup> )	Conductor Type	Color	Remarks
1	0.5	19/0.18		Coaxial
2	0.3	12/0.18	Black	Shielded
3	0.3	12/0.18	White	"
4	0.3	12/0.18	Red	"
5	1.25	50/0.18	Black	250 V
6	1.25	50/0.18	White	250 V
7	1.25	50/0.18	Red	250 V
8	0.3	12/0.18	Green	600 V
9	0.3	12/0.18	Yellow	250 V
10	0.3	12/0.18	Brown	250 V
11	0.3	12/0.18	Blue	250 V

FIG. 1-1 SPECIFICATION OF COMPOSITE CABLE



## SECTION 2

### INSTALLATION

#### 2.1 PLANNING

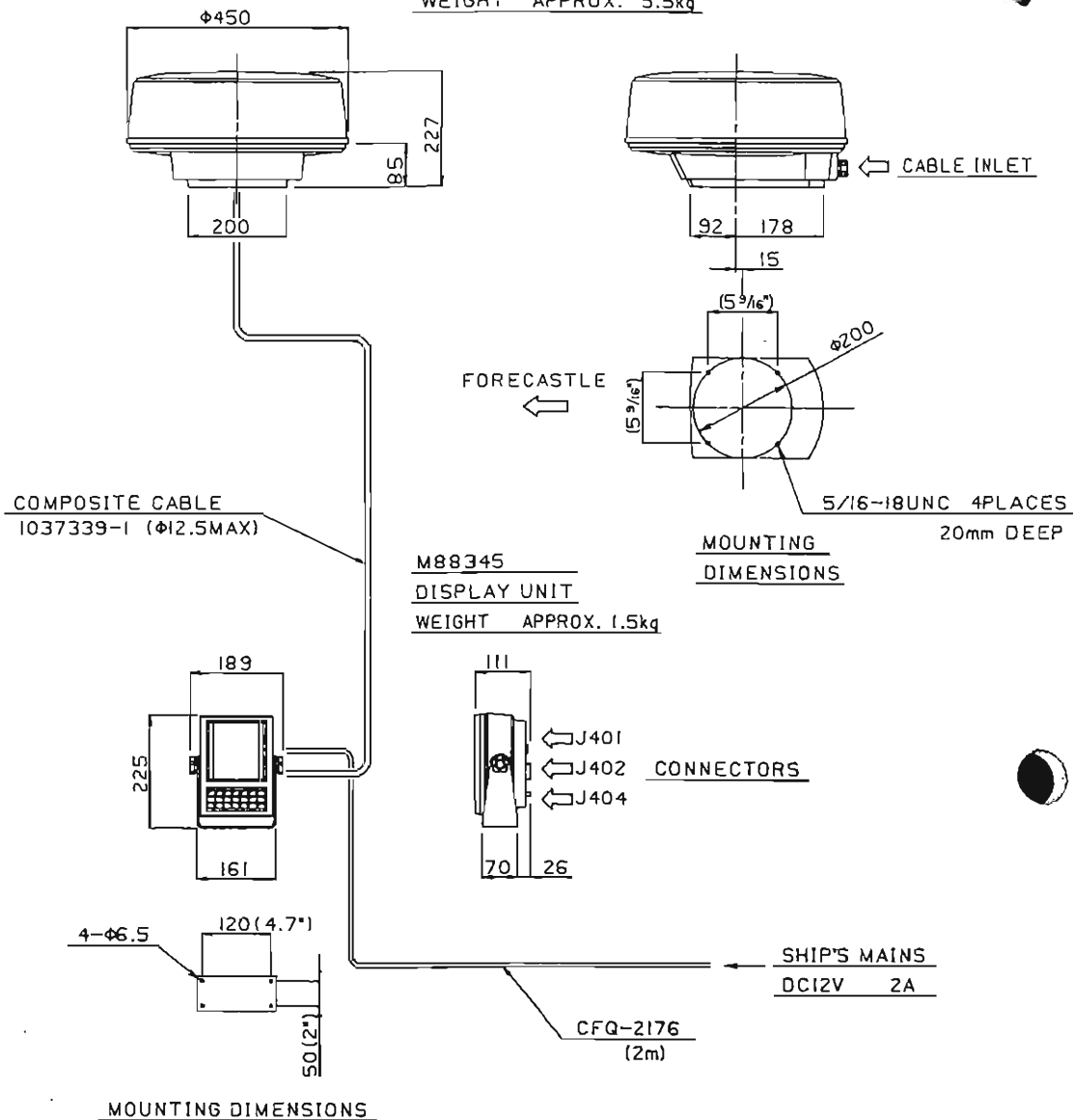
The layout for installing the LDR 9910 radar should be planned to give the best operation and service aboard your particular ship. In general, the scanner unit should be mounted atop the cabin bridge, or mast as high as possible. The display unit should be installed near the helm at a convenient viewing position.

A 6 meter length of vinyl-covered, shielded, 11 conductor cable is furnished for interconnecting the two main units (scanner and display). This length of cable should be sufficient to fabricate the cable runs required on most small vessels. Additional cable may be ordered from APELCO. The maximum cable length from the scanner unit to the display unit should not exceed 15 meters.

Figure 2-1 shows the General System Drawing for the LDR 9910 radar.



M88307 SCANNER UNIT  
WEIGHT APPROX. 5.5kg



NOTES: 1. THE DISTANCE BETWEEN THE UNITS IS AS FOLLOWS:

	STANDARD	MAX
SCANNER UNIT TO DISPLAY UNIT	6 m	15 m
2. TO ASSIST IN MINIMIZING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR, ALL CABLES OF RADAR ARE TO BE RUN SEPARATELY FROM THE CABLES OF RADIO EQUIPMENT. ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OF RADIO EQUIPMENT.		

FIG. 2-1 General System Drawing

## 2.2 INSTALLATION OF SCANNER UNIT

### 2.2.1 Selecting the Location

Selecting an adequate location for the scanner unit requires careful consideration. On many small ships, the unit can be installed directly on the top deck of the wheelhouse near the ship's centerline. The unit should be mounted as high as possible on the ship to ensure best performance at the maximum range.

The radiator beam should not be obstructed by nearby large objects. Locate the unit where large structures such as superstructures, searchlights, horns, or masts are not in the same horizontal plane, otherwise, blind areas and false targets can appear on the radar screen.

### 2.2.2 Mounting the Scanner Unit

Using the outline drawing of figure 2-2 as a guide, install the scanner unit and secure to the mounting surface. The correct mounting hardware is stainless steel hexhead bolts  $5/16"$ ,  $1\frac{1}{4}"$  long with 18 UNC thread. A flat and locking washer should be used. The mounting surface for the scanner unit should be parallel with the ship's waterline. If mounting directly to a top deck does not give sufficient height or clearance, a radar mast or pedestal may be used to raise the unit.

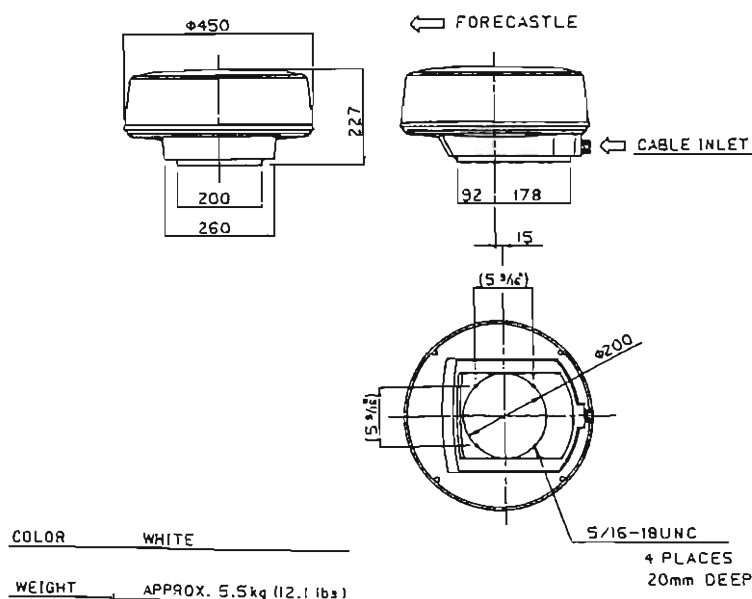


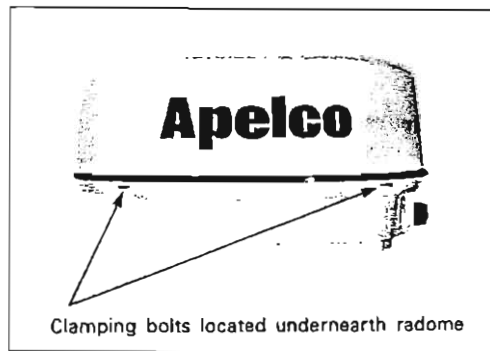
FIG. 2-2 Mounting Dimensions

### 2.2.3 Disconnecting and Reconnecting the Scanner Unit Cable

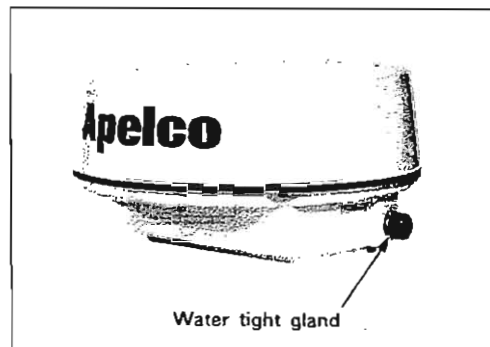
The scanner unit will be supplied with the interconnect cable hard wired at the antenna and a plug for connection to the indicator. If your installation does not allow you to run the cable with the plug attached, the hard wired cable can be disconnected from the scanner.

Refer to the following steps to disconnect the cable from the scanner unit.

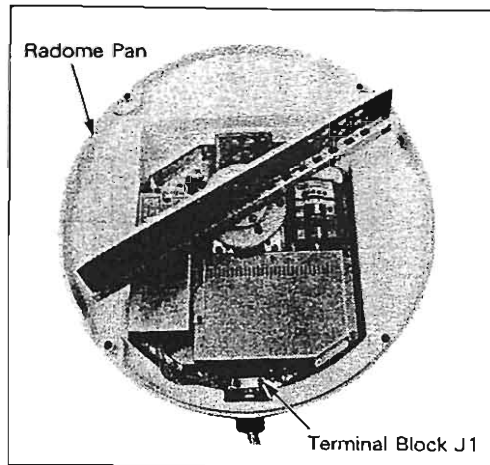
- Step 1: Remove the 4 clamping bolts securing the radome and remove radome.



- Step 2: Loosen watertight gland where the interconnect cable enters the antenna.



Step 3: Locate terminal block J1. Remove the individual wires connected to the terminal block. Make note of each wire's color and location on the terminal block, as it is removed, for reference when reconnecting the cable



Step 4: Route cable from indicator unit to the antenna unit and reconnect the cable to the terminal block J1.

## 2.3 INSTALLATION OF DISPLAY UNIT

### 2.3.1 Selecting the Location

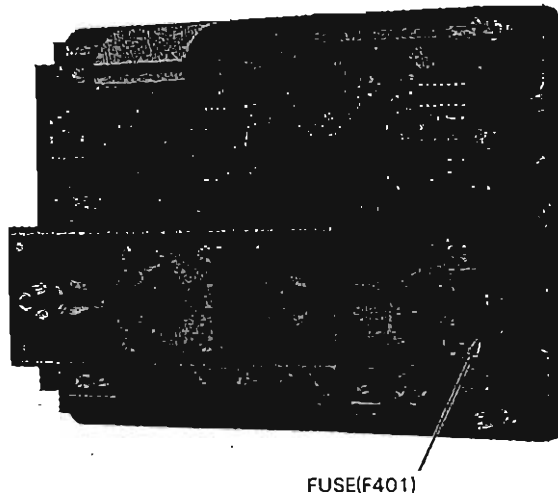
Ideally, the display unit should be located at the helm so the radar screen can be viewed while looking forward from the wheel. The display unit can be mounted on top of the chart table or installed against the bulkhead.

### 2.3.2 Mounting the Display Unit

Using the outline of figure 2-3 as a guide, install the display unit and secure to the mounting surface.

### 2.3.3 DC Power Cable

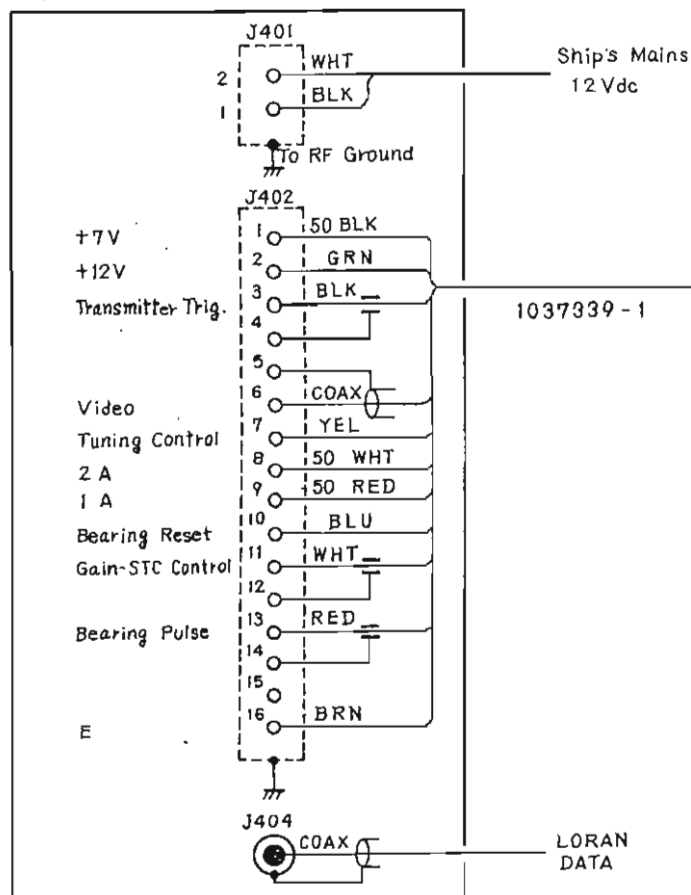
The LDR 9910 radar will work with any ship's mains within the 11 to 16 volts range, since a power regulator circuit is built-in. Connect the power cable to a DC source capable of supplying at least 2.5 amperes. The power cable normally should be wired through the circuit breaker. The white lead wire of the power cable should be connected to the positive source terminal and the black lead to negative source terminal. The shielded wire should be connected to the ship's RF ground. Should the power connections be inadvertently reversed, protective fuse F401 (3A) will blow. Recheck the input power leads for correct polarity with a VOM, reconnect the leads observing correct polarity and replace the fuse. F401 is located inside the indicator unit. It will be necessary to remove the screws on the back cover and remove the back cover to locate F401.



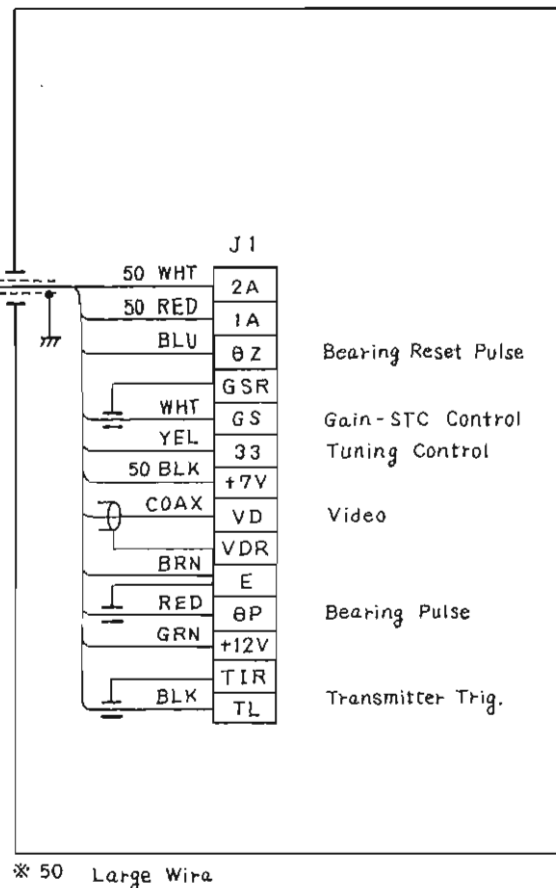
*Fuse Replacement*

Inter unit connections

# M 88345 DISPLAY UNIT



# M 88307 SCANNER UNIT



### 2.3.4 Loran Interface

The LDR 9910 radar will interface with any Loran that has the standard NMEA0182 or 0183 output. All current Apelco and Raytheon lorans have this output.

To connect the LDR 9910 to your loran unit, all that is needed is a 50Ω coax cable with the appropriate connectors. The connector needed for the LDR 9910 (J404) is a BNC type. Most loran manufacturers also use BNC connectors for their output. 50Ω coax cable such as RG58 A/U with BNC connectors can be obtained from many electronic stores.

If you do not connect the radar to your Loran C, be sure that the BNC connector plastic cover is not removed.

### 2.3.5 Connecting the cables

Connecting the cables to J401, J402 and J404.

Figure 2-3 details the connecting of the display unit.

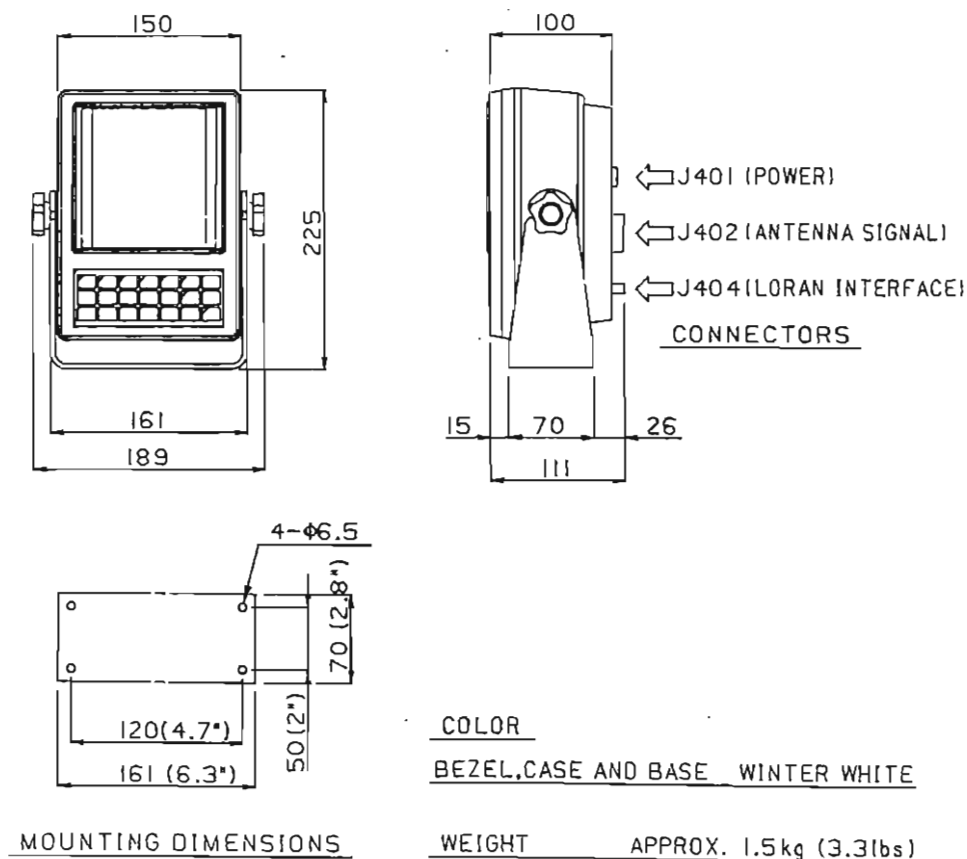


FIG. 2-3 DISPLAY MOUNTING GUIDE



## 2.4 INITIAL OPERATION AND CHECKOUT

### 2.4.1 Inspection after Installation

After completing the installation, it is necessary to assure that all the steps of the installation were accomplished in accordance with the instructions.

In particular, inspect to insure that the cables are not crimped or damaged and the input voltage connected accurately; the securing bolts of all equipment is tightened; and that the connection of the power cable shield is made properly to RF ground.

### 2.4.2 Operational Check

Apply power to radar and switch to standby by pressing **ST-BY/OFF** switch. In approximately 90 seconds the sign on the screen should change from "LDR 9910" to "READY".

Press the **X-MIT/OFF** switch and observe presence of a sweep, range rings, and heading line. While selecting different ranges, observe that the sweep is the correct length and has two range rings on each scale.

Set the GAIN control and observe the presence of targets and noise. Set SEA CLUTTER control on 1/2nm scale and note the reduction of close in targets.

After approximately 10 minutes of operation, set the TUNE control and check that maximum target returns occur at the center of the control range. If tuning control is off center, refer to section 4.1.

### 2.4.3 Relative Bearing Alignment

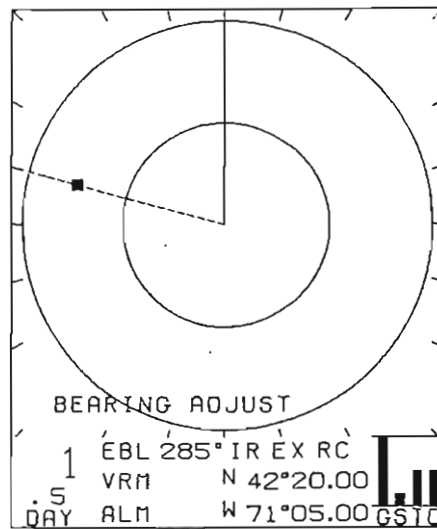
This alignment must be made when the radar unit is installed. Failure to perform this procedure can result in incorrect target bearing readings.

Proceed as follows:

- 1) Locate and remove the soft plastic cover located on the bottom of the display unit. Refer to figure 2-4.
- 2) Identify a suitable target (e.g., buoy, etc.) preferably between 1 and 2 nm in range on the screen.
- 3) Visually locate the target and line the bow of the vessel up with the target.
- 4) Locate the bearing of the target on the display.
- 5) Put the EBL marker on the target.
- 6) Set BRP (Bearing Adjust Fine) at its mid position.
- 7) Press the RINGS key until the buzzer sounds and the display indicates "BEARING ADJUST".
- 8) Adjust BRC (Bearing Adjust Course) so that the target will be within  $\pm 10$  degree of the heading line on the display and simulta-

neously the beeper should sound continuously. Then adjust BRF until the target is located underneath the heading line on the display.

- 9) Press the RINGS key until the "BEARING ADJUST" readout extinguishes, this will restore normal operation.
- 10) Proceed to the next adjustment (2.4.4) before reinstalling the soft plastic cover.



DISPLAY OF  
BEARING ADJUST MODE

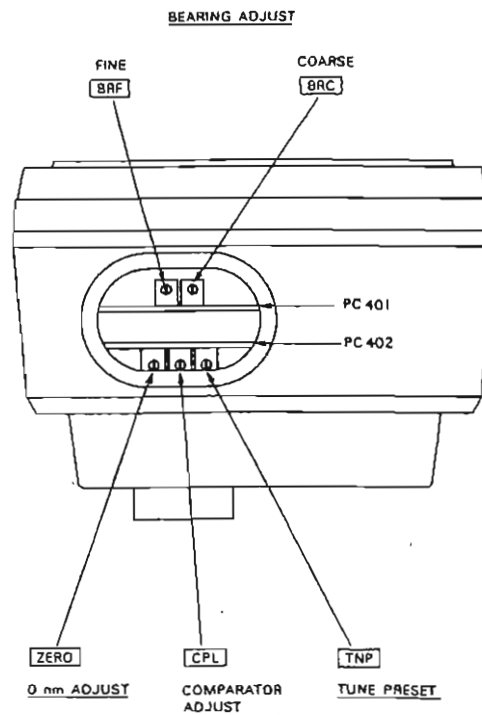
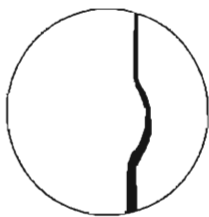


FIG. 2-4 BEARING AND 0 NM ALIGNMENT

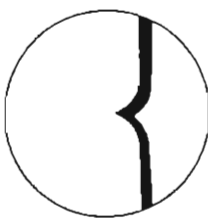
#### 2.4.4 0 NM (ZERO NM) ADJUSTMENT

Set the range at 0.25nm and observe a target at a known (nearest) distance.

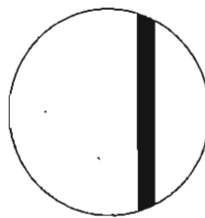
- (1) Locate a straight dock, seawall or bridge.
- (2) Position the vessel parallel to the straight target.
- (3) Adjust ZERO so that the object appears to be straight on the display.
- (4) The initial alignments are complete, reinstall the soft plastic cover.



Pushing-Display timing early



Pulling-Display timing late



Normal

NOTE: The tune preset and the comparator controls are pre adjusted at the factory for proper operation. Normally further adjustment is not required and should not be attempted by persons other than service technicians.

## SECTION 3

### OPERATION

#### 3.1 OPERATING CONTROLS

Generally the operation of the LDR 9910 is easy straight forward. However, the navigator who knows the layout and understands the functions of the various controls will obtain the best performance from his equipment.

##### 3.1.1 Layout of the controls

Layout of the controls is shown in figure 3-1

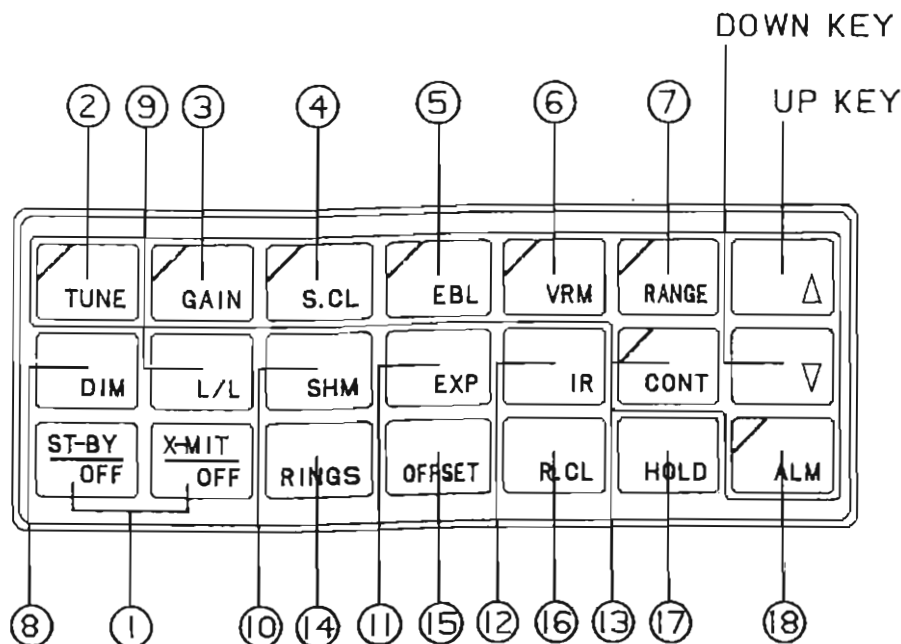


FIG. 3-1 OPERATING CONTROLS

##### 3.1.2 Function of the controls

- 1) POWER ( ST-BY/OFF, X-MIT/OFF )

In the "OFF" state there is no power applied to the radar system (without power supply control circuit).

Upon pressing the ST-BY/OFF switch, power is supplied to the scanner and display unit, and "LDR 9910" is displayed on the screen indicating the warming up condition.

Approximately 90 seconds after initial switching to "ST-BY", the sign will disappear from the screen and the sign "READY" will be displayed on the screen. The radar is now in ready and available for operation.

Pressing the **X-MIT/OFF** switch enables the radar to transmit and targets will be displayed on the screen.

By pressing the **ST-BY/OFF** switch the radar will return to the standby condition with the transmitter "OFF" and "ST-BY" appears on the screen.

By pressing the **ST-BY/OFF** and **X-MIT/OFF** switches simultaneously, the radar will turn off and all alpha-numeric informations will extinguish.

2) TUNE

Press the **TUNE** key until the area around the "T" on the bar graph located on the lower righthand corner of the display darkens. Now press the blue **UP** or **DOWN** key to adjust the tuning of radar. Observe the display while adjusting the tune control and adjust for the most targets. The bar graph gives an indication of the tune setting.

3) GAIN

Press the **GAIN** key until the area around the "G" on the bar graph darkens. Now press the **UP** or **DOWN** keys to adjust the gain. The gain control varies the sensitivity of the receiver.

4) SEA CLUTTER (S.CL)

Press the **S.CL** key until the area around the "S" on the bar graph darkens. Now the sea-clutter adjustment can be controlled by (less than 3 miles) clutter from waves.

5) ELECTRONIC BEARING LINE (EBL)

Press the **EBL** key until the area around EBL darkens. A digital bearing readout will appear and a dotted bearing line will appear on the screen. By pressing the **UP** or **DOWN** keys to EBL line can be moved to any location on the screen to take a relative bearing reading. When the **UP** or **DOWN** keys are first pressed, the EBL line moves in 1° increments. If you hold the key in, the EBL will move in large increments. To turn off the EBL, press the **EBL** key.

6) VARIABLE RANGE MARKER (VRM)

Press the **VRM** key until the area around VRM darkens. A digital range reading will appear and a dotted range ring will appear if the range of the radar is more than the digital VRM readout. The **UP** or **DOWN** key will vary the VRM to enable you to take a range reading of a target. To turn off the VRM, press the VRM key.

- 7) RANGE  
Press the **RANGE** key until the area around the range darkens. The **UP** or **DOWN** key will select the desired range.
- 8) DIMMER (DIM)  
The **DIM** key has four settings, off and three levels of brightness. Press the key alternately until the desired level of back-lighting is obtained.
- 9) L/L  
This key turns on or off the display of Lat/Long coordinates. The LDR 9910 must be interfaced with a loran C for the function to work.
- 10) SHIPS HEADING MARKER (SHM)  
This key turns the ships heading marker on or off. The marker will extinguish only as long as the SHM key is pressed.
- 11) TARGET EXPANDER  
This key turns the target expander on or off alternately. When the target expander is on, all targets are enlarged for better visibility.
- 12) INTERFERENCE REJECT (IR)  
The **IR** key will turn the interference rejection on or off alternately. When on, an IR character will appear on the screen. This feature will eliminate interference caused by other radars in the area.
- 13) CONTRAST (CONT)  
Press the **CONT** key until the area around the "C" darkens, then press the **UP** or **DOWN** key to adjust the contrast of the display.
- 14) RINGS  
This key turns the range rings on or off alternately.
- 15) OFFSET  
The **OFFSET** key shifts the display approximately 1/4 radius down expanding the display area in front of the vessel. Press the key a second time to restore the normal display.
- 16) RAIN CLUTTER (R.CL)  
This key turns the rain clutter control on or off alternately. Rain clutter is to break up the returns from rain or snow targets.
- 17) HOLD  
Pressing this key will freeze the display, releasing the key returns the unit to its normal display.
- 18) SEA GUARD ALARM (ALM)  
Press the **ALM** key until the area around the ALM darkens and a range reading appears. Press the **UP** or **DOWN** key to adjust the range of the seaguard. A broken double ring will appear on the screen at the set range. When first turned on, the seaguard will cover 360°. Press the **ALM** key once for 180° in front of the vessel. Pressing the

ALM key once more will turn off the seaguard. Once the seaguard has been set, if a target enters the seaguard, an audible alarm will sound.

### 3.1.3 OPERATING PROCEDURE

To switch "ON" the radar, proceed as follows :

- 1) Press the ST-BY/OFF switch.
- 2) After the display changes from "LDR 9910" to "READY" (approx. 90 seconds), press the X-MIT/OFF switch.
- 3) Set the contrast control to obtain the desired contrast.
- 4) Assure the RAIN CLUTTER, SEA CLUTTER are "OFF".
- 5) Adjust GAIN control to produce a light background speckle on the screen.
- 6) Adjust TUNE control for maximum echoes on the screen. If there is no target available (that is, in the open sea) adjust tuning for the maximum strength of sea clutter.
- 7) Set the RANGE for the scale you wish to cover.
- 8) As desire, rain clutter, IR, EXP, Sea clutter.
- 9) When the radar is no longer required, depress the ST-BY/OFF and X-MIT/OFF switches together at the same time. If you wish to keep the radar in a state of immediate readiness, press the ST-BY/OFF switch. The screen will indicate "STANDBY", the radar will be kept in the standby condition.

## 3.2 USING THE CONTROLS

### 3.2.1 TUNE Control

The magnetron and the local oscillator may take about 10 minutes to completely stabilize on frequency. So after switching "ON" and tuning initially, the tuning should be rechecked after the first 10 minutes.

Symptoms that the equipment may be out of tune are a lack of distant echoes or the appearance of double echoes (one echo behind another). The coarse method of tuning is described in Section 4. Normally it is possible to fine tune the radar by selecting a comparatively weak echo and then press the **TUNE** key and the UP or DOWN key until the strongest echos and best definition are observed.

### 3.2.2 GAIN Control

The correct setting of the **GAIN** is for light background speckle to be just visible on the screen. The equipment is then in its most sensitive condition. Objects will be detected at the greatest possible range. With too little gain, weak targets may be missed and there can be a decrease in detection range. With excessive gain (a few) extra targets may be brought in, but the contrast between echoes and background noise will be substantially reduced, making target observation more difficult.

In crowded regions gain might be temporarily reduced to clarify the picture. This must be done with care since important marks may be missed. With gain at its normal setting, clutter from rain or snow may obscure the echo from a ship inside a squall or storm. A temporary reduction in gain will usually permit the stronger and more distinct ship's echo to be distinguished.

Detection of targets beyond the storm may, however, require slightly higher gain than normal, since the clutter may have attenuated, but not completely obscured, echoes from the targets. The **GAIN** should be always reset to its normal level as soon as any temporary alteration is no longer required.

### 3.2.3 SEA CLUTTER Control

Whereas the **GAIN** control affects the strength of echoes at all ranges, the effect of the **SEA CLUTTER** control is greatest on short-range echoes, becoming progressively less as range increases. The **SEA CLUTTER** control is only effective up to a maximum of about three miles.

The **SEA CLUTTER** keys reduce the strength of false echoes received from waves at short range. The setting used should be sufficient to reduce the strength of signals until clutter appears only as small dots, or until small targets can be distinguished, the setting should never be advanced so



far as to blank out all clutter entirely.

The sensitivity level of the **SEA CLUTTER** can be set in 32 steps, thus enabling an optimum picture to be obtained under adverse weather conditions.

The **SEA CLUTTER** keys may be used to reduce some rain or snow clutter, as well as strong sea clutter, in the immediate vicinity of the vessel. A temporary increase in the setting will usually permit strong echoes from ships, and most navigational marks inside storms or squalls, to be distinguished.

At close range, in crowded regions, the **STC** level may be temporarily increased to clear the picture. This should be done with care, so as to avoid missing important echoes. The **SEA CLUTTER** level should be always reset to the minimum required amount for a normal presentation after any temporary alteration.

#### 3.2.4 RAIN CLUTTER Switch

During heavy rain or snow which may clutter the picture, use **RAIN CLUTTER** to give better detection between echoes and the clutter. Under some conditions of sea return, both **RAIN CLUTTER** and **SEA CLUTTER** will help to clarify the picture. When viewing large masses of land, coastlines, etc. **RAIN CLUTTER** reduces the background and will cause prominent shoreline to stand out more clearly.

#### 3.2.5 IR Switch

When another ship is using the same frequency radar as that of your own radar, interference typically appears arranged in curved spokes as shown in Figure 3-2. The radar interference is mainly noticeable on longer range scales.

Using the **IR** switch will eliminate this form of interference as well as any other form of synchronous noise.

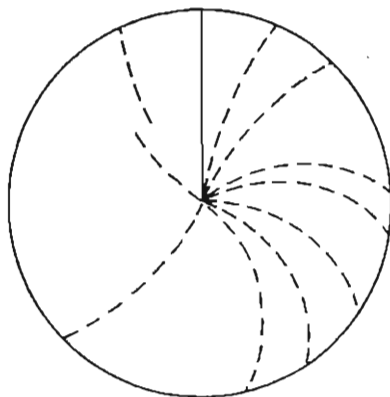


FIG. 3-2 RADAR INTERFERENCE

### 3.3 NAVIGATION WITH THE RADAR

#### 3.3.1 Obtaining a Position Fix

The LDR 9910 Radar is an accurate and reliable navigational aid for determining your ship's position. Figure 3-3 shows examples of alternative methods of using radar sightings from prominent navigational points which can be identified on a chart. A position fix based on two or more navigational points will furnish a more accurate fix, especially when the points approach 90 degrees apart from your ship's position.

#### 3.3.2 Avoiding Collision

The moment a target appears on the screen, its range and relative bearing should be noted. This is best done on a plotting sheet or chart.

As in visual observation, "a constant bearing indicates a collision course".

As soon as a series of plots indicates a closing range and no significant change in successive bearings, positive action should be considered mandatory and "The Regulations for Preventing Collisions at Sea" should be observed.

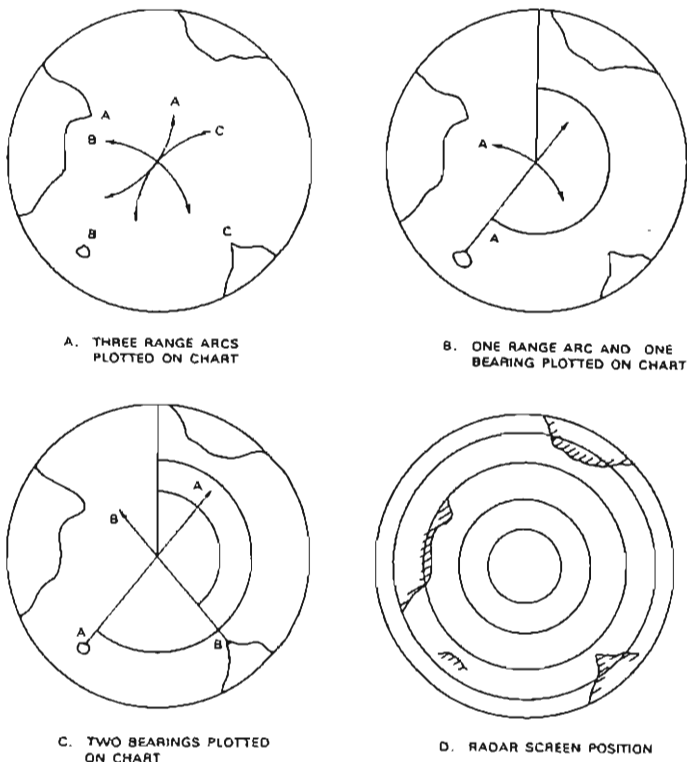


FIG. 3-3 POSITION FIX METHODS

### 3.3.3 Range measurements using the VRM

- 1) Press the VRM key to display the variable range marker.
- 2) Press UP or DOWN key to move the variable range marker to the closest edge to the target. Target distance will be displayed in lower character area.

### 3.3.4 Bearing measurements using the EBL

- 1) Press the EBL key to display the electronic bearing line.
- 2) Press UP or DOWN key to move to electronic bearing line to the center of the target. The target relative bearing is displayed on the lower character area.

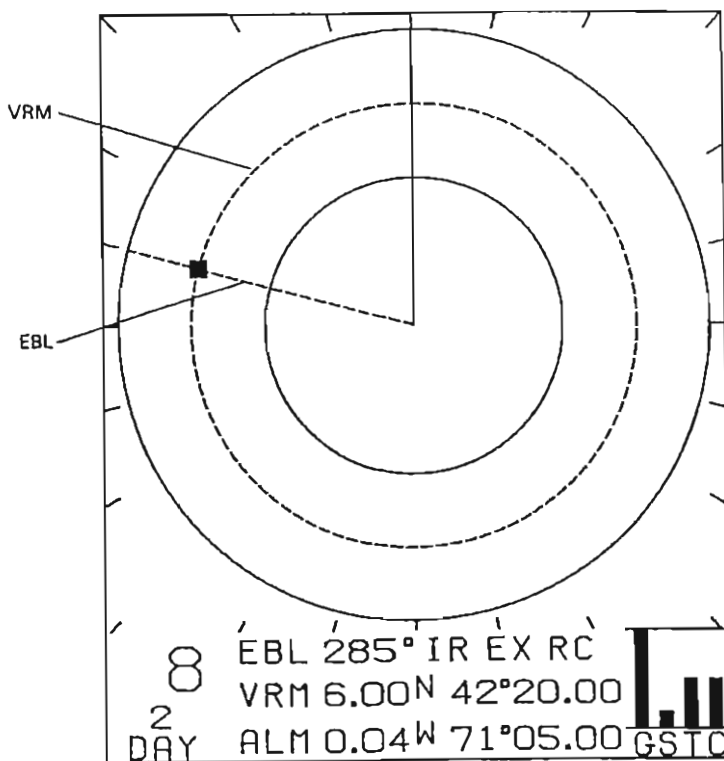


FIG. 3-4 RANGE AND BEARING MEASUREMENT

### 3.3.5 Displaying your position on the radar display

Press the L/L key to display your present Lat/Long on the LCD of the radar.

### 3.4 DETERMINING YOUR RADAR LINE-OF-SIGHT RANGE

When searching for distant targets, your radar line-of-sight range to the target can be a limiting factor. Radar waves behave like light waves but they are refracted slightly more, increasing the distance to the radar horizon slightly more than that to the optical horizon (however, displayed range is correct). As Figure 3-5 shows, the radar line-of-sight range is a combination of the radar horizon of your ship's radar scanner and the radar horizon of the target.

The distance to the radar horizon under conditions, may be calculated from the formula.

$$\text{Distance (nm)} = 2.23 \sqrt{h}$$

$h$  = Height of the radar scanner off the water line (in meters)

For example, a scanner at a height of 2 meters has a radar horizon of 3.2 nm.

A 3 meters cliff has a radar horizon of 3.9 nm. Therefore, under standard conditions, the cliff should begin to appear on the screen when the ship closes nearer than  $3.2 + 3.9 = 7.1$  nm.

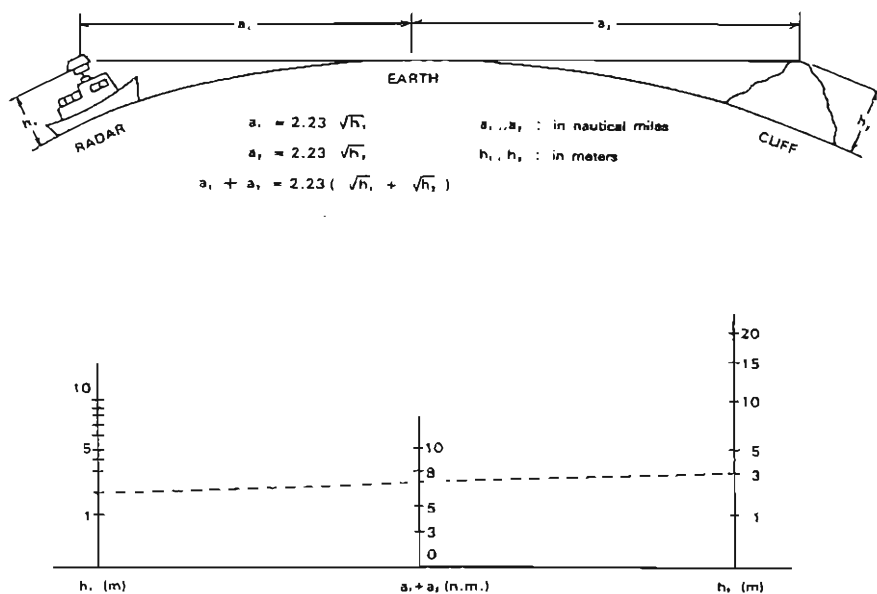


FIG. 3-5 RADAR HORIZON

### 3.5 FALSE ECHOES

Occasionally, signals appear on the screen at positions where there is no target. They are false echoes.

The following are known as the most common false echoes.

#### 3.5.1 Side Echoes

With every radar antenna some radiation escapes on each side of the main beam as side lobes. If they are strong reflected by a target, and be displayed on the screen as an echo. (See Figure 3-6)

These echoes often appear as arcs echoes at each side of the true echo.

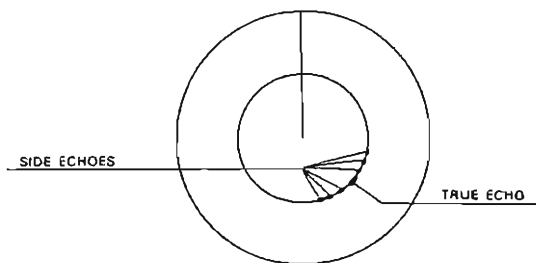


FIG. 3-6 SIDE ECHOES

#### 3.5.2 Indirect Echoes

As shown in Figure 3-7, indirect echoes may appear if there is a large target, such as a passing ship at a short range or a reflecting surface, such as a funnel on your own ship. The signal, on first striking the smooth side of the large target, will be deflected. Then it encounters a second target, the echo will return along the same paths to the scanner. Thus, the echo from the second target will appear beyond that of the large target but on the same bearing. The indirect echoes will also appear when the signal is deflected by the reflecting surface.

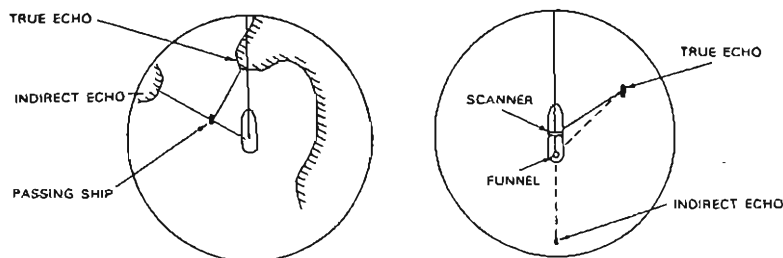


FIG. 3-7 INDIRECT ECHOES

### 3.5.3 Multiple Echoes

The multiple echoes may appear if there is a large target having a wide vertical surface parallel to your own ship at comparatively short ranges. The signal will be reflected by the wide vertical surface, then the reflected signal strikes your own ship, and it will return along the same paths to the target. This will be repeated.

Thus, the multiple echoes will appear beyond the true target's echo on the same bearing as shown in Figure 3-8.

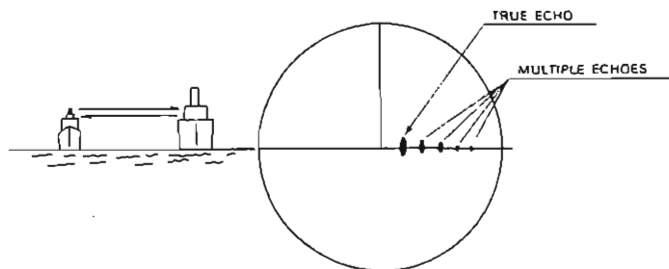


FIG. 3-8 MULTIPLE ECHOES

### 3.5.4 Ghost Echoes

The ghost echoes may appear if there is a target having a wide smooth surface near your own ship. As shown in Figure 3-9, the appearance of the ghost echoes is similar to that of the indirect echoes.

The ghost echoes appear on the screen as if you saw the target reflected in a mirror.

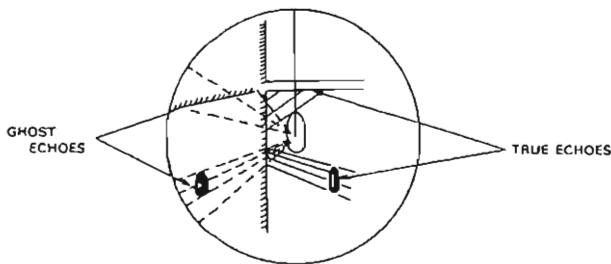


FIG. 3-9 GHOST ECHOES

### 3.5.5 Shadows

Although the scanner unit should be ideally placed where there is a good all-around view, as far away as possible from any part of the ship's superstructure or rigging to reflect the beam, there may be some obstructions. An obstruction will throw either a complete or partial shadow as shown in Figure 3-10.

If there are targets in a shadow sector, target echoes may not be displayed on the screen. Thus, it is important to know the bearings and width of all shadow sectors, and it can be checked by turning the **SEA CLUTTER** control to zero when light rain clutter covers much of the screen and the sea is calm.

Any Shadow will then be shown as dark sectors in the clutter.

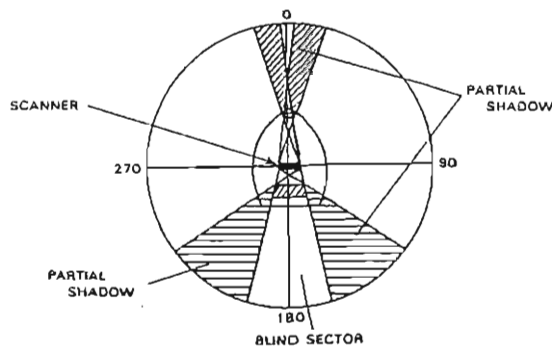


FIG. 3-10 SHADOWS

# SECTION 4

## ADJUSTMENT

Although the radar is delivered adjusted for optimum performance, it may be necessary to make adjustments after a major component has been replaced or if a fault is suspected during operation.

### REPLACEMENT ITEM

Magnetron V201

Frontend E301

Reed switch S101

### ADJUSTMENT REQUIRED

Local oscillator tuning

Local oscillator tuning

Bearing alignment

#### 4.1 Local Oscillator Tuning

- (1) About 10 minutes after operating the radar, set range between 0.5 and 2 nm.
- (2) Set the TUNE control of the display to its midposition.
- (3) Remove the display's lower cover
- (4) Set the GAIN control so that noise on the sweep trace is discernible.
- (5) Adjust TNP (TUNE PRESET) in the display unit to obtain maximum amount of echoes on the screen.

#### 4.2 Comparator Level Adjustment

- (1) Remove the lower cover from the display unit.
- (2) Set the GAIN control fully clockwise.
- (3) Turn IR "ON"
- (4) Adjust CPL (PC401) until some background speckle is present on the screen.

#### 4.3 AVR Adjustment (In Scanner Unit)

- (1) Remove the radome from the pedestal of the scanner unit.
- (2) Adjust RV1 (AVR ADJ) located on PC201 so that the dc output voltage at J1- +7V on PC201 is +7V.





# SECTION 5

## TECHNICAL DESCRIPTION

### 5.1 BLOCK DIAGRAM

#### 5.1.1 General

The overall system block diagram can be considered as being comprised of two main sections. One for the scanner unit circuit diagram ; the other for the display unit circuit diagram. The following description of the block diagram explains the individual circuits described in Chapter 5.2 and 5.3.

The motor-encoder and SHM pulse generator are used to synchronize the bearing of the radar display, display timing and transmit-triggering. Setting the operate switch to "STBY" position activates the power supply which in turn provides operating voltages to all circuits of the radar. After about 90 seconds, setting the operate switch to "ON" position allows transmitter triggering and the radar becomes operational.

#### 5.1.2 Scanner Unit

The scanner unit includes the scanner drive mechanism together with the transmitter and receiver. These three sections are housed within an 18" radome.

##### 1) Radiator

The radiator is a horizontally polarized, PCB array. The radiator is driven at 27 rpm by a motor-encoder via reduction mechanism.

##### 2) Motor-encoder

The scanner motor is a DC motor which incorporates a reduction mechanism and encoder. The input voltage of the motor is 12 V DC. The encoder generates a bearing pulse every 0.176 degree of 2048 pulses for each complete rotation of the radiator.

##### 3) Bearing reset pulse generator

The SHM pulse generator consists of a reed switch and permanent magnet which is mounted on the main reduction gear. The SHM pulse resets the bearing counter in the display unit.

##### 4) Modulator

A line-type pulse is used in the modulator. The charging method used

is via DC charge. A silicon controlled rectifier (SCR) is used as the high power switch of the pulser. The pulse repetition frequency (PRF) rate is 920 Hz.

5) Magnetron Transmitter

A voltage of the required pulse width is fed to the magnetron which generates high energy oscillations in the region of 9445 MHz for the duration of the input pulse. The operating point of magnetron is at a voltage of  $-1.85\text{KV}$  and a current of  $2\text{A}$ .

6) Duplexer

A Diode Limiter is fitted in the waveguide between the magnetron and the micro frontend. It serves as a barrier to protect the frontend from the high amplitude r.f. energy generated by the magnetron. While this high RF power is present, the diode limiter behaves like a short circuit across the waveguide. Thus the output power of magnetron is directed towards the radiator. Echo pulses entering the radiator and waveguide pass through the diode limiter which deionizes following transmission so that echo energy will reach the micro frontend.

7) Frontend

The micro frontend contains the mixer and local oscillator. The micro frontend output feeds a  $60\text{ MHz}$  IF signal to the IF amplifier.

8) I.F. Amplifier

The I.F. amplifier consists of two stages. The first stage is a low noise transistor amplifier; the second is a linear integrated circuit amplifier stage. The second stage is controlled by the GAIN-SEA CLUTTER signal from the display unit.

9) Detector

In this stage, I.F. ( $60\text{MHz}$ ) component is removed leaving video rate signals for display.

10) Video Circuit

This circuit is primarily an emitter follower which feeds the video signal from the detector to the display unit providing an impedance match to the coaxial cable.

11) AVR Circuit

The AVR circuit generates a regulated output voltage of  $16\text{ V DC}$  from the ship's mains of  $12\text{ V DC}$ .

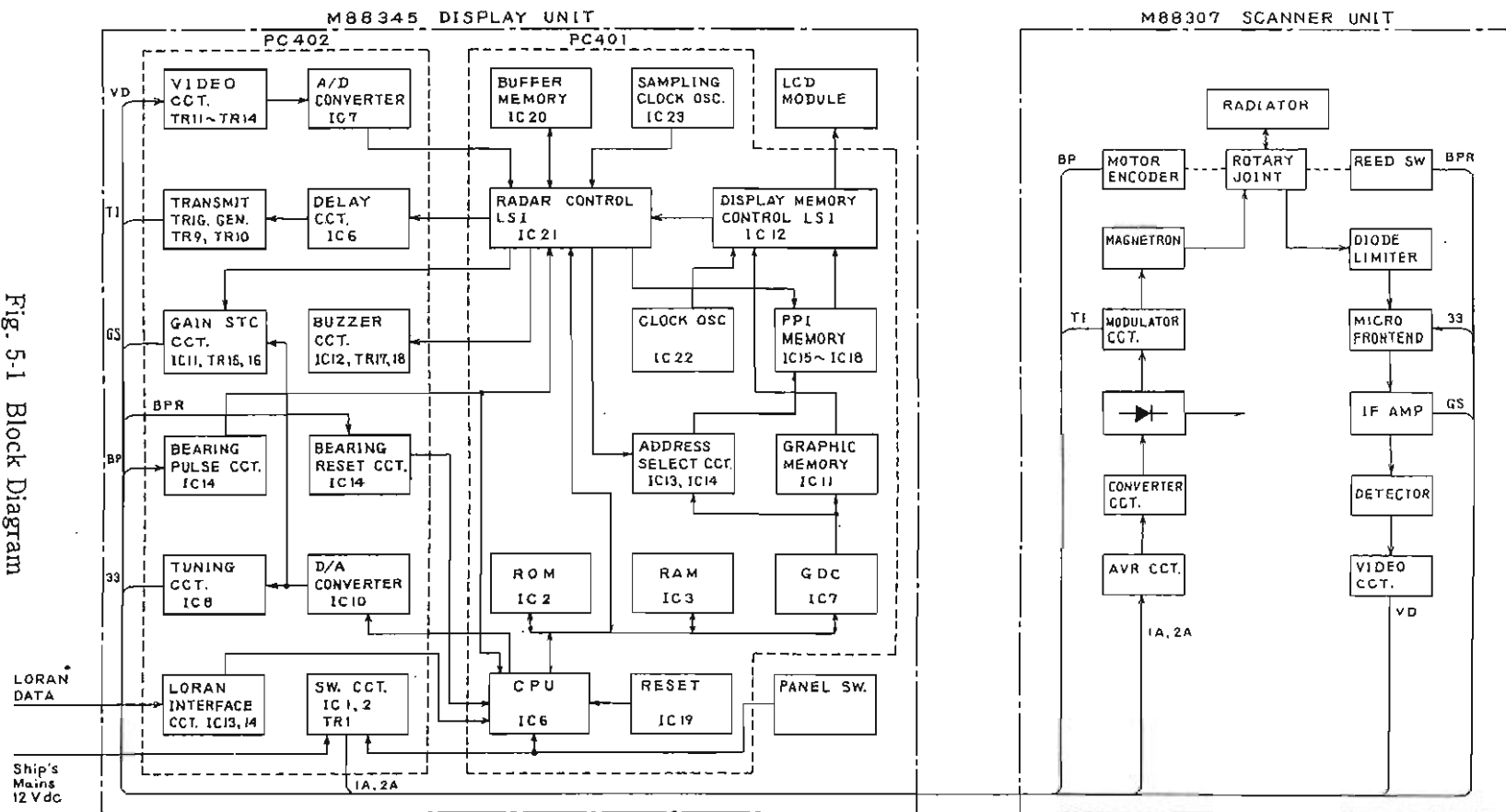
12) Converter Circuit

The converter circuit converts the  $16\text{ V DC}$  output of AVR into three levels of voltage which are required for the scanner and the display unit operation. The outputs are  $+7\text{ V}$ ,  $+12\text{ V}$ , and  $+220\text{ V DC}$ .

### 5.1.3 Display Unit

The display unit consists of the main control circuits, LCD module

Fig. 5-1 Block Diagram



and power supply.

The display unit is fed with the video and bearing synchronizing signals from the scanner unit via a multicore cable. Semi-conductors and integrated circuits are used throughout the display.

1) Video circuit

The video circuit consists of the FTC (rain-clutter) circuit, inverting amplifier, dc restorer circuit and emitter follower.

2) Comparator

The comparator generates a digital pulse train from the input analog video signal. The comparator level adjust RV2 (PC2), set the video threshold point.

3) Buffer memory

The buffer memory stores the video data of 2 successive transmissions. A single transmission video is stored into 128 memory cells.

4) Sampling clock oscillator

The sampling clock oscillator generates at 15.5 MHz.

5) PPI memory

The PPI memory stores the PPI video data. PPI memory consists of four 64 kbit memory ICs.

6) Delay Circuit (0 nm Adjust)

The delay circuit produces a variable delay time for adjusting the PPI center to 0 nm as compensation for transmitter firing delays.

7) Transmitter trigger generator

The transmitter trigger generator produces the pulse for driving the modulator in the scanner unit.

8) Radar control LSI

The radar control LSI produces the data and address for buffer memory, transmitter trigger, STC trigger pulse, alarm flag pulse, data for PPI memory and write address for PPI memory from CPU control data, the video signal and bearing pulse.

9) Display memory control LSI

The display memory control LSI produces the signal for PPI and graphic memories from GDC (graphic display controller) outputs.

10) Gain, STC (sea clutter) circuit

The gain STC circuit controls the sensitivity of the receiver in response to the setting of the gain and sea clutter controls on the control panel. At sea, the effect of random signals received from waves at short ranges can be reduced with the sea clutter control.

11) Address select circuit

The address select circuit selects the write address from the radar control LSI and the read address from GDC output.

12) Clock oscillator

The clock oscillator generates 24 MHz for the system control.

13) Graphic memory

The graphic memory stores the graphic and characters (256 Kbit).

14) Tuning circuit

The tuning circuit produces the voltage for the tuning control of micro frontend in the scanner unit.

15) D/A converter

The D/A converter produces the voltages for gain level, STC level, tuning, contrast of LCD, brilliance of EL module and lamps for control panel from CPU data.

16) GDC (graphic display control)

The GDC produces most data displayed on the LCD except the PPI echo data and the alarm flag data, for example, VRM, EBL, all characters, range rings, bearing markers and SHM signal.

## 5.2 SCANNER UNIT

The scanner unit consists of the radiator, the motor-encoder, radiator rotating mechanism, bearing reset sw, transmitter unit, receiver unit and power supply unit. These components are housed within the 18" radome.

### 5.2.1 Radiator, Motor-encoder, Radiator Rotating Mechanism, Bearing Reset sw.

1) Radiator

The radiator is horizontally polarized PCB array. The radiator, approximately 15" in length is coupled to the transmitter and receiver via a short waveguide, rotary joint.

At half power point horizontal beamwidth is 6° and vertical beamwidth is 25°. Side lobes are better than -21 dB with respect to the main beam. The direction of maximum radiated power is perpendicular to the radiator.

2) Motor-Encoder

A 12 V DC motor is used to rotate the radiator. The encoder section of the assembly produces the bearing pulses for the rotation synchronization. A bearing sync pulse is generated every 0.176 degrees of rotation (2048 pulses per 360°) at 12 V DC amplitude. These pulses are sent through J1-OP to the Bearing Pulse Generator in the Display Unit.

3) Radiator Rotating Mechanism

Mechanical coupling between the radiator and the motor-encoder is affected by reduction drive mechanism. The motor rotates at approx. 27 rpm. The reduction ratio is 1 : 30.

4) Bearing Reset Sw

Bearing reset sw produces the bearing counter reset pulse when the permanent magnet fitted on the main gear passes across Reed Switch S101. The resulting bearing reset pulse is sent to the Display Unit.

### 5.2.2 Transmitter and Power Supply

#### 1) Modulator

The line-type pulser is used in the modulator and consists of a charging choke, SCR switch, PFN and pulse transformer.

Circuit component

L4	: Charging Choke
CD10	: SCR Switch
T2	: Pulse Transformer

and the PFN consists of L5, C25, C26.

By setting the OPERATE switch on the control panel to "X-MIT" position, the modulator trigger pulse is fed to the base of TR4 from the transmitter trigger generator circuit in the display unit.

The MOD-MH of 220 VDC is fed to the PFN capacitor C25 and C26 via L4. Because of the resonant charging action of L4, the PFN reaches almost twice the voltage of the input. Since the charging efficiency is approximately 90%, the PFN voltage reaches nearly + 400V.

On receiving a positive pulse at gate of CD10 from the emitter follower TR4 via R27, the SCR switch begins to conduct and the voltage which is charged across the PFN capacitor is discharged via CD11 and T2.

Consequently, the pulse determined by the PFN appears on the primary windings of the pulse transformer T2 and this pulse is stepped up to the cathode of the magnetron via T2 (approximately 1 : 14.5).

The peak voltage of the pulse on the pulse transformer primary windings is approximately -140V, and the magnetron cathode voltage is -1.85kV. The pulse length is 0.3 usec.

#### 2) Magnetron

While the high voltage pulse is fed to the cathode of the magnetron, the magnetron generates high energy oscillations in the region of 9445 MHz for the duration of the input pulse.

#### 3) Power Supply

The power supply circuit is designed to provide the various power outputs for the whole radar from nominal ship's mains for 12 VDC. The power supply circuit consists of the switching type AVR, the converter, the control circuit, and the rectifier circuits.

The basic circuit of the power supply for 12V operation is shown in

Figure 5-2.

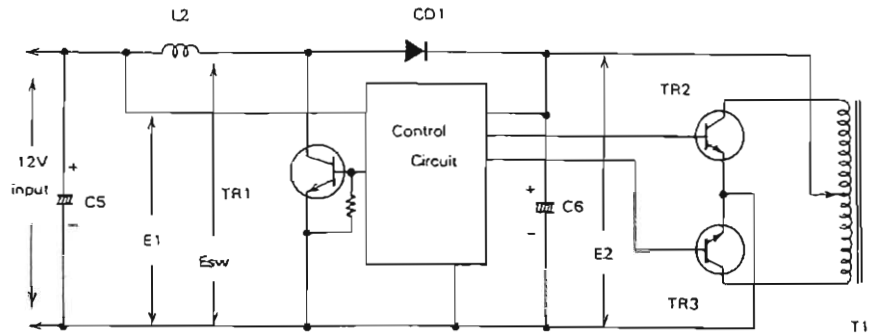


FIG. 5-2 THE BASIC CIRCUIT

(A) AVR circuit

While the transistor switch is ON, energy is sufficiently charged into the inductor. During the OFF time, the charged energy in the inductor is added on the supply voltage, and is fed to the load and capacitor C5 via diode CD1.

While the switch is ON, the capacitor continuously feeds the power to the load ; therefore, the output is held to the constant voltage. Voltage across transistor switch Esw is shown in Figure 5-3. Its peak value is equal to the output voltage E2. Therefore, the supply voltage is given by the time average of the output voltage.

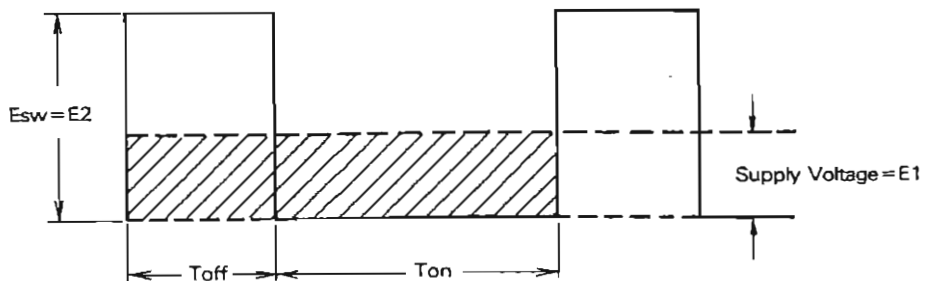


FIG. 5-3 ACROSS VOLTAGE OF THE TRANSISTOR SWITCH



Consequently, the output voltage is described in the following equation :

$$E2 = \frac{T_{on} + T_{off}}{T_{off}} - E1$$

(B) Converter

TR2 and TR3 are transistor switches, and the complementary squarewaves are fed to TR2-B and TR3-B. The 22KHz square wave appears on the primary windings of T1. The secondary outputs of T1 are fed to the rectifier circuits.

(C) Control Circuit

IC2 drives the converter TR2, TR3 and AVR control TR1.

The switching frequency is determined by C13 and R13.

The 22KHz squarewave is superimposed on the reference voltage of IC1-14. This reference voltage is fed to IC1-2 and the output voltage is fed to IC1-1 via the AVR ADJ RV1. These two voltages are compared in IC1: the output pulse appears on IC1-9.

This output pulse controls the transistor switch. The regulated output is adjusted to 16V by RV1.

(D) Rectifier Circuits

The +220V, +12V and +7V are produced in this circuit and fed to display unit and scanner unit.

(E) HV Protection Circuit

This circuit is provided to prevent a short circuit of the power supply when the SCR (Modulator circuit) is continuously held in a conductive condition.

IC3-2 triggers on a negative-going signal when HV voltage (+220V) reaches +100V (voltage of IC3-2 reaches +4V). Once triggered, the IC3-3 is held +12V until the set time has elapsed. The duration of the set time is given by  $T = 1.1 \times (R23) \times (C20)$  and is about 1 sec.. As a result, K1 is OFF and the power supply circuit and the modulator circuit are separated.

### 5.2.3 Receiver

1) Micro Frontend

The micro frontend E301 contains a mixer and a local oscillator. It produces the IF signal (60MHz) output by combining the input RF signals and the local oscillator output frequency. The tuning of the micro frontend is controlled from the display front panel and the display internal tune preset control.

2) I.F. Amplifier

The I.F. Amplifier consists of three amplifying stages. The first stage is transistor amplifier which is designed to provide a good noise figure. The noise figure of this circuit is determined by the collector current of the transistor, approximately 3.5 mA. The next two stages are the integrated circuit (IC) amplifiers. These stages are controlled by the GAIN-STC circuit in the display unit. The GAIN-STC control voltage is fed to the bias terminal (5) of IC1 and IC2.

GAIN-STC control voltage on J1-GS (at STC control min.) for maximum gain is approximately 5V and for minimum gain approximately 9V.

3) Second Detector

The second detector is an IC detector which operates as a sensitive detector amplifier. The negative going video signal appears across R11, the I.F. component is removed, and the video signal is fed to the video circuit.

4) Video Circuit

The emitter follower operates as an impedance transformer to drive the coaxial cable which feeds the video signal to the display unit.

## 5.3 DISPLAY UNIT

### 5.3.1 General

All components of the display unit are mounted on the printed circuit boards. The display unit circuitry consists of the main control (1), main control (2) and LCD assembly.

### 5.3.2 Video circuit

The incoming negative going video signals is fed to the FTC (rain clutter) circuit. The FTC circuit consists of a capacitor C24, a resistor R37, and a diode CD5. The CD5 operates as a diode switch which is controlled by the R.CL switch on the control panel via the transistor TR9. In the "OFF" state of the rain-clutter switch, CD5 is conductive, and the video signals are fed to the TR10 without being differentiated. In the "ON" state of the rain-clutter switch, CD5 is not conductive and the video signal is differentiated by C24 and R37.

The negative going output of the FTC circuit is amplified by TR10 and the inverted (positive going) output signal on the TR10 TR10 collector. The output of the TR10 is fed to the DC restore circuit via the emitter follower TR11. The DC restore circuit consists of CD7 and followed by TR12.

### 5.3.3 A/D converter

The A/D converter IC7 changes the analog video signal into a digital pulse train and produces the negative going pulses on IC7-7. The digital video output is fed to the radar control LSI IC21-15.

### 5.3.4 Radar control LSI

The radar control LSI IC21 consists of the buffer memory control circuits, the STC trigger generator, transmitter trigger generator, alarm circuit, IR circuit, EXP circuit, scan converter circuit and PPI memory control circuit.

This IC21 is controlled by CPU (IC6), the clock from the display memory control LSI (IC12) and the sampling clock oscillator.

### 5.3.5 Buffer memory (IC20)

The video pulses from IC21-18 appear at the input of the buffer memory (IC20-12). The displayed range (each sweep radius) is divided into 128 range cells. Therefore, the required buffer memory will be 128 bits for the video data of the each transmission. Two transmissions of video data will be stored in the buffer memory for the interference rejection. This video data is written into the memory when the writing pulse is fed to

IC20-9. The memory address data are inputted on A0-A8 from the radar control LSI (IC21) and the read data are fed to "PVDI" (IC21-30).

#### 5.3.6 Sampling clock oscillator

The sampling clock oscillator IC23 generates 15.5 MHz clock pulses and is followed by the inverting buffer. The output of IC23-4 is fed to IC21-16.

#### 5.3.7 Delay circuit

IC6 is a monostable multivibrator, given by C22, R34 and RV1. The receiving video signal is controlled by RV1 to display correct distance.

#### 5.3.8 Transmitter trigger generator

The delayed TIY from IC6-13 generates about 4 microsecond pulse at IC6. This pulse is amplified by TR8 and drives the antenna modulator through TR7 emitter follower.

#### 5.3.9 Gain STC circuit

The gain control voltage, 0V for max, and 12V for min., is fed from the D/A converter (IC10-10). Its voltage is compressed into 6V for max, and 10V for min, with the operational amplifier (IC11).

The sea clutter control voltage, 0V for min, and 12V for max., is fed from the D/A converter (IC10-11). Its voltage variation is compressed into 0V for min, and 4V for max, with the operational amplifier (IC11).

When S.CL and UP keys are depressed, and negative going pulse (STCT) from the radar control LSI (IC21-14) is fed to TR13-base and TR13 turns on. Therefore C31 will be charged up to a voltage of the IC11-7. After the STCT pulse is over, TR13 turns off and the voltage across C31 begins to discharge via R71. The sea clutter pulse is superimposed on the gain voltage through the coupling capacitor C32.

The GS output is filtered in the receiver unit and fed to the IF amplifier.

#### 5.3.10 Bearing pulse circuit and bearing reset circuit

The bearing pulse from the scanner unit is filtered by R74 and C38 and fed to the schmitt trigger IC14 and shaped into a suitable trigger pulse. The IC14-12 output is then fed to IC21-33 and the CPU.

The bearing reset pulse from the scanner unit is filtered by R76 and C39 and fed to IC14-11 and shaped into a suitable reset pulse. The IC14-10 output is fed to the CPU.

#### **5.3.11 Address select circuit**

The address select circuit consists of IC13 and IC14. The selection of the read/write address for the PPI memory is carried out by this address select circuit. The memory write address is sent from the radar control LSI (IC21-51 to 59) and the memory read address is sent from IC8 and IC9.

#### **5.3.12 PPI memory**

The PPI memory IC15 to IC18 store the PPI picture data for display on the LCD screen. The display area on the LCD is divided by 200 x 240 dots. The PPI memory has 512 x 512 memory cells.

#### **5.3.13 Display memory control LSI**

The display memory control LSI (IC12) produces the PPI and graphic memory control signal, the clock pulse for the radar control LSI and display timing pulses of LCD module from CPU data and 24 MHz master clock oscillator.

#### **5.3.14 Graphic memory**

The graphic memory IC11 is 4 x 64 K (256K) bit dynamic RAM. It is controlled by the GDC (IC7). All graphic data, graphic pattern and characters, are sent from the GDC through IC10 and stored in the graphic memory. The column address strobe pulse and row address strobe pulse and write enable control pulse are fed from the display memory control LSI. The graphic memory address is provided from the GDC via IC8 and IC9.

#### **5.3.15 D/A converter**

The D/A converter (IC10) produces the outputs of gain voltage, STC voltage, LCD contrast control voltage, tune control voltage, EL brilliance control voltage and panel dimmer control voltage using the CPU data.

#### **5.3.16 Tuning circuit**

The tuning circuit (IC8) produces the signal for local oscillator tuning from D/A converter IC10-15. The RV3 is the preset tuning when the magnetron or micro frontend is replaced.

## HIGH VOLTAGE WARNING

*Do not open the scanner unit when the radar is ON ; high voltages within the Scanner could be fatal to anyone coming in direct contact with it.*

*Disconnect ship's power from the Scanner and Display Unit before attempting any maintenance ; otherwise, ship's power will be present at terminals inside the Scanner and Display Unit.*

## RADIATION HAZARD

*Care should be taken to avoid possible harmful effects (particularly to the eyes) of radiation from radar transmissions.*

*To avoid harmful radiation, the Display OPERATE switch should be turned to the STBY or OFF position when working on the Scanner. Under no circumstances should you look directly into the antenna from a distance of less than 2 feet when the radar is in operation.*

# SECTION 6

## MAINTENANCE

### 6.1 GENERAL

Continuing satisfactory operation of the radar can depend on how well you take care of your equipment. The simple maintenance tips that follow can save you time, and money and help avoid premature equipment failure.

#### CAUTION

When working on the radar, make sure that the main circuit breaker switch which supplies power to the radar is open. As an additional precaution, keep the POWER switch on the display unit in the OFF position.

- (1) Always keep the equipment as clean as possible. Use a soft cloth to remove dirt, dust, water-spray as it appears.
- (2) Periodic inspection of the radar system should include the following:
  - a. Check all hardware for tightness.
  - b. Check for evidence of any corrosion of the scanner, display or cable and connectors and clean as required.
  - c. Check cable connectors and terminal strip connectors for cleanliness and tightness. Make sure the wiring is free from chafing or abrasions.

## 6.2 SCANNER UNIT

### 6.2.1 Radome

Wipe the surface of the radome with a clean, soft cloth. Check that there is no paint, dirt or caked salt. A heavy deposit of dirt or caked salt on the surface of the radome may cause a considerable drop in the radar performance.

Don't use any chemical cleaners other than alcohol.

### 6.2.2 Lubrication

Locate the main drive gear and clean away old lubrication residue and dirt.

Apply a light coating of grease (MOBILUX grease No.2 MOBIL OIL company or equivalent) on the gear of the main shaft and drive motor. Lubrication should be done every six months.

### 6.2.3 Mounting

Check the mounting bolts of the scanner unit and tighten as necessary.



## 6.3 DISPLAY UNIT

### 6.3.1 Cleaning the screen

The face of screen filter and LCD module will, in time, accumulate a film of contaminants which tends to dim the picture.

### 6.3.2 EL PANEL REPLACEMENT

The EL panel for LCD backlighting has life of approximately 5000 hours. If adjustment of the EL brilliance control seems to have no effect, replacement of the EL panel may be required.

- (1) Remove the LCD assembly.
- (2) Disconnect the EL panel leads from the LCD module.
- (3) Pull the EL panel out of the LCD module.
- (4) To reassemble, reverse the above procedure.

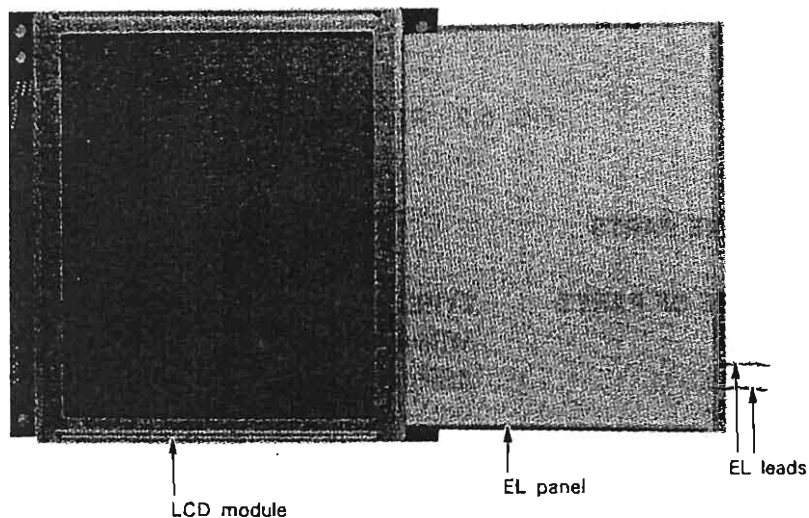


FIG. 6-1 REPLACEMENT EL PANEL